

# Mathematical Optimization of Artificial Neural Network Regression for Mineral Composition of Different Tea Types

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Tea contains numerous minerals and has effects on human nutrition. The purpose of this study was to identify the production parameters required to achieve the desired mineral content levels in teas. Four different tea varieties, black Turkish (BT), green Turkish (GT), black Ceylon (BC), and green Ceylon (GC), were used to produce tea at concentrations of 1%, 2%, and 3%. Seven different brewing times were used to produce these teas: 2, 5, 10, 20, 30, 45, and 60 min. Inductively coupled plasma-optical emission spectrometry (ICP-OES) was used to examine tea infusion samples for the minerals Al, Ca, Cd, Cr, Cu, Hg, Fe, K, Mg, Mn, Na, Pg, and Zn. For each mineral, artificial neural network (ANN) regressions were built, and the regressions were then optimized to find the production parameters needed to achieve the appropriate concentrations of minerals. The highest  $R^2$  values were for the Mg (0.9890) and Na (0.9878) regression equations, while the lowest  $R^2$  values were for the Cu (0.9076) and Al (0.9431) regression equations. According to the optimization results, the highest Fe content (0.278 mg/L) can be obtained with 3%, 60 min, and GC tea, while 1%, 2 min, and GC tea are required to obtain the lowest Al content (2.136 mg/L).

**Keywords:** Tea, Mineral, Artificial neural network regression, Mathematical optimization

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